

ELECTRONIC FUNDAMENTALS

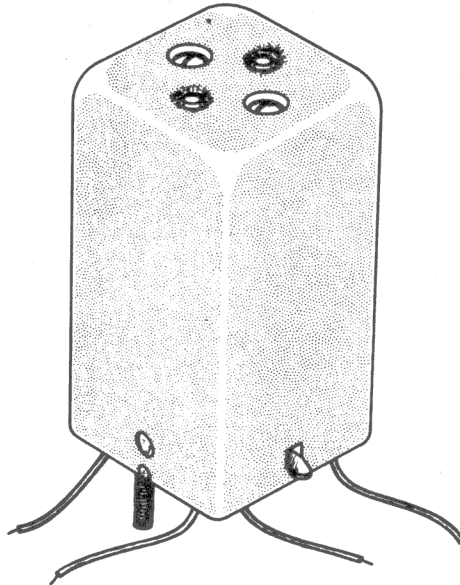
EXPERIMENT LESSON 27

DETECTOR EXPERIMENTS



RCA INSTITUTES, INC.
A SERVICE OF RADIO CORPORATION OF AMERICA
HOME STUDY SCHOOL
350 West 4th Street, New York 14, N. Y.

universal i-f transformer



All the parts in Kit 14 are listed below. Check the parts you receive against this list. Make sure you have the correct quantity of every item. If a part is either missing or defective upon arrival, request a replacement from Department R, Home Study School, RCA Institutes, Inc., 350 West 4th Street, New York 14, N.Y. *Your request must include your name and student number, the complete name and description of the part copied from the Item column below, the Quantity missing or defective, and the reason you are asking for a new part.*

KIT 14

BILL OF MATERIALS

Item	Quantity
1	6BA6 electron tube
1	Universal i-f transformer <i>RK1402</i>
1	Capacitor, variable
1	Antenna coil, adjustable core, with mounting bracket
5'	Hookup wire
1	Capacitor, 0.01 μ f, 400 volts
1	Resistor, 470 k-ohms, $\frac{1}{2}$ watt
1	Resistor, 1.5 megohms, $\frac{1}{2}$ watt
1	#8-32 x $\frac{1}{8}$ " round-head machine screw
1	Tube shield and clip

If you get a part slightly different from a part described in this list, the substitute part will not interfere electrically or mechanically with your experiments or equipment.

Experiment Lesson 27

INTRODUCTION

The detection process is an important part of the method by which the audio signal is recovered from the high-frequency carrier that is used to transmit it. There are two important steps to the detection process: rectification and filtering. These have been explained in the Theory Lesson on detection. In this experiment lesson, you will perform each of these basic steps separately, and see the contribution of each one to the detection process.

You will then build a number of different detector circuits, learn their operating characteristics, and test them for their sensitivity and selectivity.

If possible at your location, actual broadcast signals will be used to compare the various detectors. If broadcast signals cannot be received at your location with a reasonable length of antenna, your signal generator will be used as a source of modulated r-f signal. The signal generator delivers to the r-f output jack either an unmodulated r-f signal, as in Fig. 27-1a, or a modulated r-f signal as shown in Fig. 27-1b. Unmodulated r-f signals are obtained when the AF OUT/INT MOD switch is turned off. When this switch is turned on, the r-f output is modulated about 30% with a 400-cycle audio signal. The percentage of modulation cannot be varied with the control; it can only be turned on or off.

EQUIPMENT NEEDED

Radio receiver chassis
Multimeter
Signal generator
6BA6 electron tube

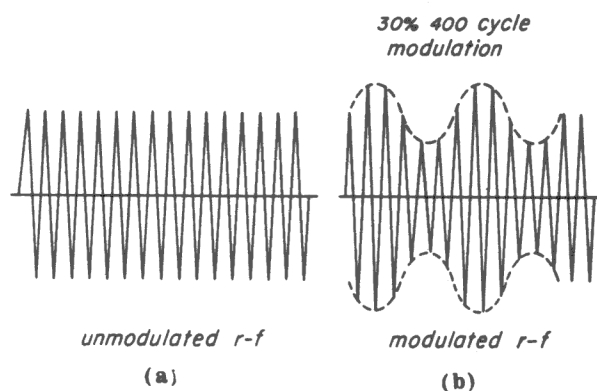


Fig. 27-1

Crystal-diode holder (from Kit 6)

Three 2-lug terminal strips

One 1-k-ohm $\frac{1}{2}$ -watt resistor

One 5 k-ohm 10-watt resistor

One 10 k-ohm 5-watt resistor

One 22 k-ohm $\frac{1}{2}$ -watt resistor

One 100 k-ohm $\frac{1}{2}$ -watt resistor

One 1.5 megohm $\frac{1}{2}$ -watt resistor

One 0.1- μ f capacitor (from capacitor board)

One 0.02- μ f capacitor (from capacitor board)

One 0.25- μ f capacitor (from capacitor board)

Two 0.01- μ f capacitors

One 470- μ f capacitor

One 270- μ f capacitor

Hookup wire

Variable capacitor, with mounting hardware

Ferrite core antenna coil, with mounting hardware

IN34 crystal diode (temporarily removed from meter)

Note: See instructions below before removing crystal diode.

JOB 27-1

To prepare the chassis for detector experiments.

Procedure.

Step 1. Open the multimeter and carefully remove one of the crystal diodes.

Caution: The multimeter should not be used to measure a-c voltages while one of the diodes is removed. Damage to the other diode may result if voltages in excess of 50 volts are applied to the meter. Put some kind of tag on your meter to remind you of this until you replace the diode. The meter can still be used for d-c voltage and resistance measurements.

Step 2. Connect a 0.01- μ f capacitor from pin 3 (plate) of the 6K6-GT tube socket to the ground lug near pin 6 of this socket. Use spaghetti on the capacitor leads.

Step 3. Mount a 2-lug terminal strip in the position shown in Fig. 27-2. This terminal strip will be referred to as TS-H. Label it on your chassis.

Step 4. Connect the diode holder across TS-H with short leads. Make sure that the crystal diode is not in the holder whenever any soldering is done.

Step 5. Connect a lead from lug 2 of TS-H to terminal 3 of the volume control.

Step 6. Plug in the radio receiver, turn it on, and allow the tubes to warm up. Test the audio amplifier section by putting your finger on lug 2 of TS-H and turning the volume con-

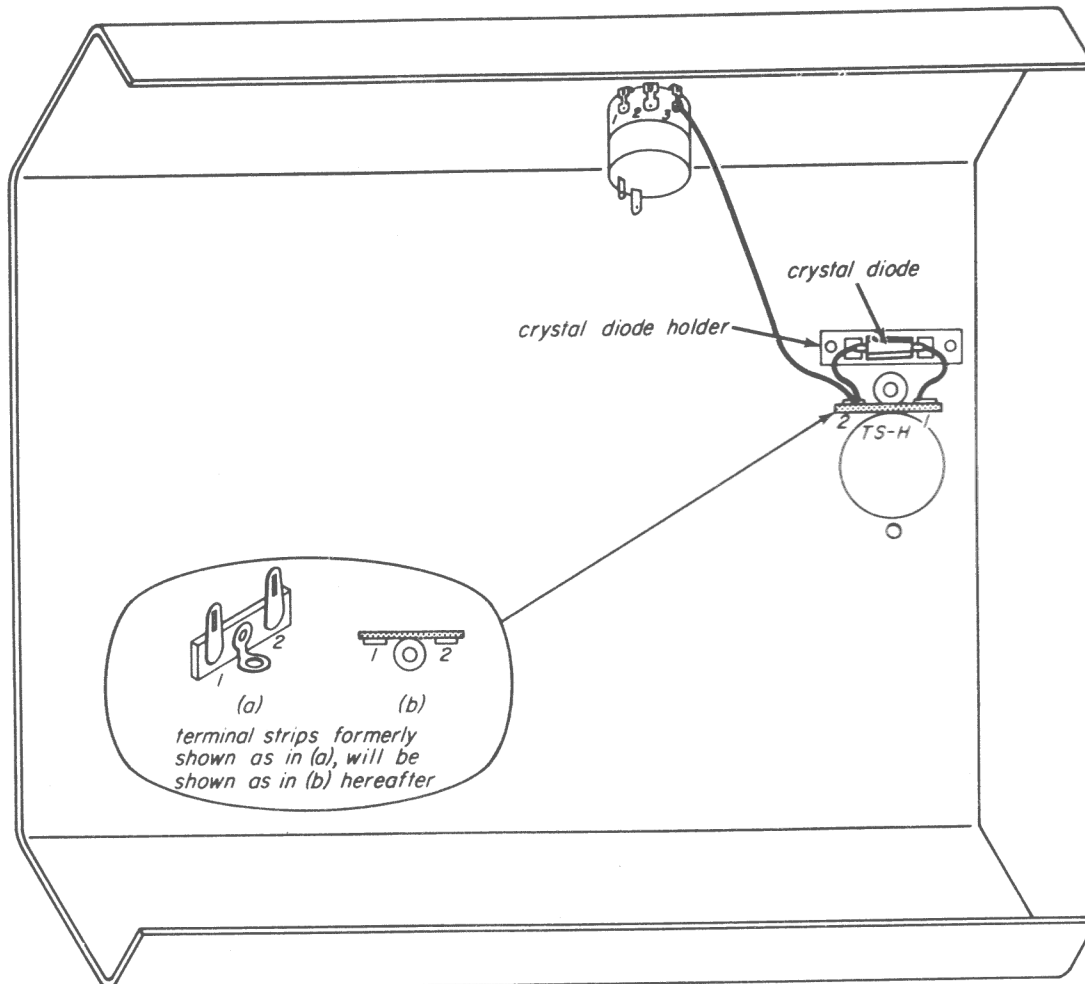


Fig. 27-2

trol up to maximum. A loud hum should be heard in the loudspeaker indicating that the audio amplifier is operating. If you do not get this hum, check your wiring and locate the trouble before you proceed with the experiments.

EXPERIMENT 27-1.

To study the part played by rectification in the detection process.

Procedure.

Step 1. Plug in the signal generator and allow it to warm up. Connect the output cable to the RF OUTPUT jack.

Step 2. Set the bandswitch to Band B and the tuning dial to 600 kc. Turn the AF OUT/INT MOD control to the off position, and the RF ATTEN control to its maximum clockwise position.

Step 3. Insert the crystal diode in the holder, with the diode facing in either direction.

Step 4. Set up the multimeter to the 500 VDC range, and connect it to lug 3 of TS-C (plate of the 6AT6 tube.)

Step 5. Connect the ground clip of the signal generator cable to the chassis, and touch the high side of the cable to lug 2 of TS-H while observing the meter. Note whether the meter reading changes.

Step 6. If the plate voltage changes, reduce the volume control setting slightly and again touch the high side of the output cable to lug 2 of TS-H. Repeat until there is no change in plate voltage when the signal is applied. The volume-control setting should be as near maximum as possible without causing a change in plate voltage when the signal is applied.

Step 7. Connect the output cable to the lug 2 of TS-H, and turn the AF OUT/INT MOD control on and the RF ATTEN control maximum clockwise.

Is an audio signal heard in the loudspeaker?

Step 8. Move the high side of the signal generator cable to lug 1 of TS-H, so that the signal passes through the crystal diode. Is an audio signal heard in the loudspeaker? Why? How do you explain the difference in results for Step 7 and Step 8?

Step 9. Remove the crystal, reverse it and put it back in the crystal holder. Repeat Step 8.

How do the results compare with those of Step 8?

Step 10. Turn off the receiver and unplug the power cord.

EXPERIMENT 27-2

To construct and study the characteristics of a crystal detector.

Information. Be very careful in the handling of the variable capacitor and the ferrite-core antenna coil. Both are fragile and can be easily damaged, and replacement is expensive.

Whenever handling the variable capacitor, keep the rotor plates fully meshed within the stator plates, as this makes the plates less likely to be bent. When mounting the capacitor, be sure to use the screws specified, as longer screws may go too far into the frame and bend the plates. Do not turn the trimmer capacitors unless instructed to do so.

The wires of the antenna coil and the antenna-coil form are delicate and should be handled very carefully. The ferrite core is brittle and will break if it is dropped!

Procedure.

Step 1. Remove the mounting screw holding TS-G, and mount the tuning capacitor, using three 6-32 x 1/4 inch screws, as shown

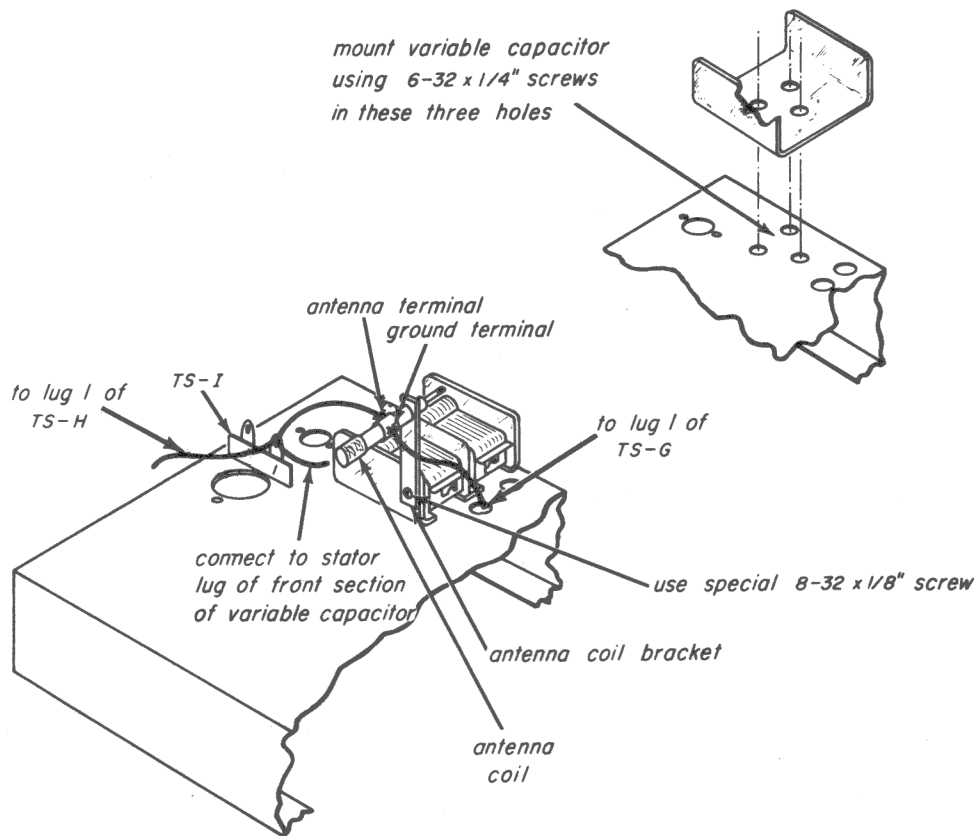


Fig. 27-3

in Fig. 27-3. Remount TS-G in its original position underneath the chassis with one of the screws.

Step 2. Using the same screw and nut that holds TS-H, mount another 2-lug terminal strip on *top* of the chassis, as shown. This terminal strip will be referred to as TS-I. Label it on your chassis.

Step 3. Carefully unwrap the short piece of wire which is wound around the bottom of the antenna-coil form. This wire, which is about 12 inches long, is connected to one of the lugs on the coil form. Mark the lug to which the wire is connected ANT (for antenna) and mark the other lug GND (for ground). Then cut off this 12-inch piece of wire and put it aside.

Step 4. Mount the antenna coil bracket as shown in the figure, using the 8-32 x 1/8-inch

screw provided in the tapped hole on the back of the capacitor frame.

Step 5. Insert the antenna coil into the top hole on the mounting bracket, as shown in Fig. 27-4. Hold the coil near the end of the form — do not hold the section to which the lugs are attached. Press the coil gently forward with a rocking motion until it snaps into place.

Step 6. Connect a lead from the stator lug on the right side of the front section of

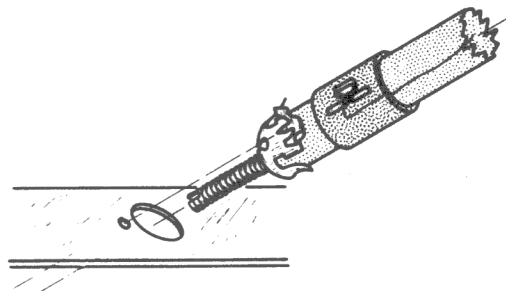


Fig. 27-4

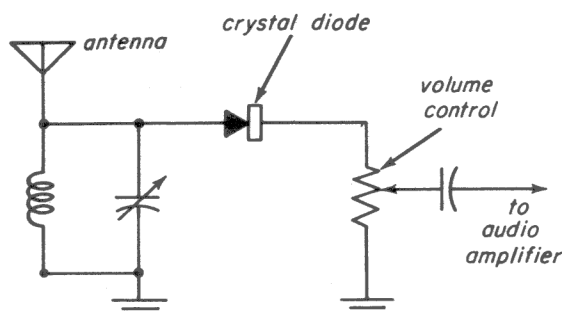


Fig. 27-5

the capacitor to lug 1 of TS-I on top of the chassis, as in Fig. 27-3.

Step 7. Connect a short lead from the ANT terminal of the antenna coil to lug 1 of TS-I on top of the chassis.

Step 8. Connect a short lead from lug 1 of TS-I around the side of the chassis to lug 1 of TS-H on bottom of the chassis.

Step 9. Connect a lead from the GND terminal of the antenna coil through the hole on the left side of the capacitor to lug 1 (chassis) of TS-G. You have wired a simple crystal detector. Compare your circuit with the schematic shown in Fig. 27-5 before you proceed.

Step 10. Connect a piece of antenna wire 10 feet long or longer to lug 1 of TS-I. (The magnet wire you have left over from your early experiments is very good for this purpose.) Stretch this wire out across the room.

Step 11. Plug in the receiver power cord, turn it on, and allow the tubes to warm up.

Step 12. Adjust the core of the antenna coil so that it is just starting to come out of the coil form.

Step 13. Tune the variable capacitor slowly and listen for broadcast stations. You should pick up several stations as you tune across the dial unless you are very far from broadcast stations. If you do not pick up any signals, try a longer antenna, or use your signal generator as a signal source as described below.

With the core just flush with the coil form, as in Step 12, adjusting the capacitor from

maximum to minimum capacity will tune through about from 530 kc to 1,100 kc. To receive stations at the high end of the broadcast band, turn the core screw so as to back the core into the coil form about 3/8 inch. The tuning range will then be about from 700 kc to 1700 kc.

Step 14. As you tune in the various stations that you are able to pick up, write down your evaluation of the following qualities:

Sensitivity:

Are many stations received? *7-10*

Is the signal loud and clear? *4-5*

Selectivity:

Is the tuning sharp? *NO OVERLAPPING*

Is it easy to separate the stations while tuning and select the desired one? *ONLY ON VERY STRONG ONES*

If only one station is received, note how far the tuning capacitor can be turned while still receiving the station. Make a rough estimate in degrees. *10° on Strong stations*

If you are in a strong signal area, or can erect an antenna 25 feet or longer, you will get better performance from the detector for broadcast listening by coupling signals into the antenna coil through a pickup coil, made as described in Step 4 of Experiment 27-3 and connected as described in Step 17 of Job 27-2.

EXPERIMENT 27-3.

To study one of the functions of filtering in a detector circuit, and to learn how the rectified d-c voltage across the diode load varies.

Procedure.

Step 1. Remove the 0.1- μ f capacitor from the capacitor board and connect it across TS-F on the receiver chassis.

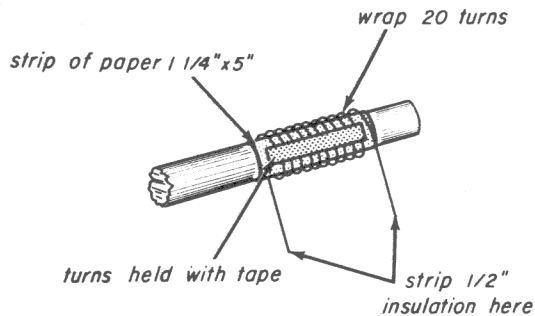


Fig. 27-6

Step 2. Connect a lead between lug 1 of TS-F and pin 3 of the 6K6-GT tube socket.

Step 3. Connect a lead between lug 2 of TS-F and pin 5 of the 6AT6. (Since the meter cannot be used for a-c measurements, one of the diodes in the 6AT6 tube will be used as a rectifier to change the a-c output at the plate of the 6K6-GT to direct current so that it can be measured by the d-c meter.)

Step 4. Prepare a small pickup coil for coupling signals into the antenna coil. To do this, cut a strip of paper about $1\frac{1}{4} \times 5$ inches, and wrap it over the coil on the antenna coil form as shown in Fig. 27-6. Wrap it so that it fits snugly, but not tightly. It should slide off easily. Fasten it with a piece of tape. Then, using magnet wire, start with a 6-inch lead and wrap twenty turns close wound (touching each other) around the paper and leave another 6-inch lead at this end. Don't let go of the wire at any time or it will spring loose. While still holding the wire tight, fasten the coil in place with more tape, as shown in the figure. Strip $\frac{1}{2}$ -inch of insulation from the leads. Do not twist the leads together, or they may short through the insulation.

Step 5. Disconnect the 10-foot antenna wire from the terminal strip. Connect the signal-generator cable to the leads of the pickup coil.

Step 6. Plug in the receiver and the signal generator and allow them to warm up. Adjust the signal generator to Band B, 600 kc, and maximum r-f output. Turn the AF OUT/INT MOD switch to the ON position.

Step 7. Set up the meter to the 500 VDC range and connect it to lug 2 of TS-F with the positive lead to the chassis. Tune the variable capacitor for maximum output. Adjust the volume control for 50 volts output and then reset the RANGE switch of the meter to the 100 VDC range.

Step 8. Holding a $470\text{-}\mu\text{f}$ capacitor by the body with your fingers, touch it across the diode load, which is the volume control in this case, and observe the meter. A convenient way to do this is to connect the capacitor from lug 2 of TS-H to chassis, and observe the meter. What is the effect on audio-output voltage?

Rises 18v

Step 9. Repeat the above using a $0.01\text{-}\mu\text{f}$ capacitor. What is the effect on the audio-output voltage?

Rises 2v

Step 10. Repeat the above using a $0.02\text{-}\mu\text{f}$ capacitor. What is the effect on the audio output voltage?

Drops 28 v

Step 11. Connect the meter to lug 2 of TS-H (across the diode load) and set it to the 5 VDC range. Record the amount of voltage and its polarity here:

- GND
1.3 v
volts d.c.

Step 12. Vary the r-f output from maximum to minimum, and note the effect on the rectified d-c voltage across the diode load.

Drops to 0

Step 13. Reverse the crystal in its holder, and raise the r-f output to maximum. Record the amount and polarity of the voltage across the diode load:

+ GND
1.3 v
volts d.c.

How does the polarity of the output voltage of a crystal detector compare with that of a power supply rectifier?

no effect

Step 14. Leave the meter connected as in Step 11, and turn off the receiver using the on-off switch. What happens to the voltage across the diode load?

Stays the same

Why? Furnished by sig. gen.

DISCUSSION

Your observations in Exp. 27-1 should show you the basic need for rectification as a part of the detection process. No audio signal is heard when the modulated r-f signal is applied directly to the grid of the audio amplifier through the volume control. (In order to study what is happening without introducing other complications, we limit the signal input to the tube so that rectification does not take place in the tube. This is done by observing the plate voltage of the 6AT6 and reducing the signal until the plate voltage does not change with applied signal). When the crystal-diode rectifier is inserted between the signal generator and the audio amplifier, the audio signal is heard because rectification of the modulated r-f signal is now taking place. As far as the audio signal is concerned, the polarity of the rectifier has no effect.

In Experiment 27-2, you constructed a crystal detector circuit consisting of three

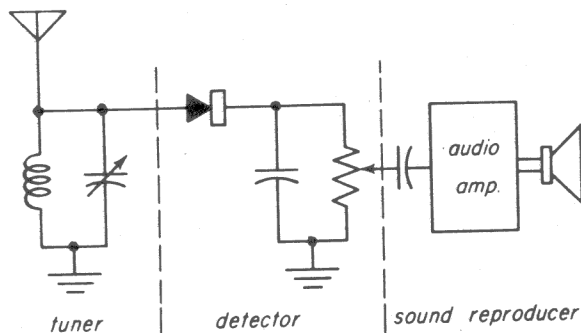


Fig. 27-7

basic parts, as shown in Fig. 27-7. The tuning circuit is a parallel-resonant circuit across which the voltage developed is a maximum at the resonant frequency. The necessary rectification is performed by the crystal-diode, and filtering is accomplished by the small capacitor across the diode load. The audio amplifier that you have previously constructed serves to amplify and reproduce the demodulated audio signals.

If you live within a reasonable distance of broadcast stations, you should be able to pick up two or more broadcast stations with this detector and an antenna 10 feet long or longer. However, you may have to stay pretty close to the loudspeaker and use maximum volume to hear them. The diode detector is not very sensitive, and it is difficult to tune sharply to the broadcast stations. However, your reception, although not loud, should be clear and undistorted.

The effect of filter capacitors across the diode load is demonstrated in Experiment 27-3. Some filter capacitance is always present due to the distributed wiring capacitance; and in this case there is also the distributed capacitance of the volume control. Small additional capacitors increase the audio output because the audio modulation envelope that is recovered follows the peaks of the r-f signal instead of the average of the r-f signal pulses. However, as the filter capacitors are made larger, this benefit is lost, because larger capacitors have less reactance to lower frequencies and begin to short out the recovered audio signal itself.

This experiment also shows that the rectified d-c voltage across the diode load, which may be used as the avc control voltage, depends upon the strength of the incoming r-f signal. The polarity of this voltage depends upon the connection of the diode, positive voltage being present when the cathode of the diode is connected to the load as in power rectifiers and negative voltage when the plate of the diode is connected to the load.

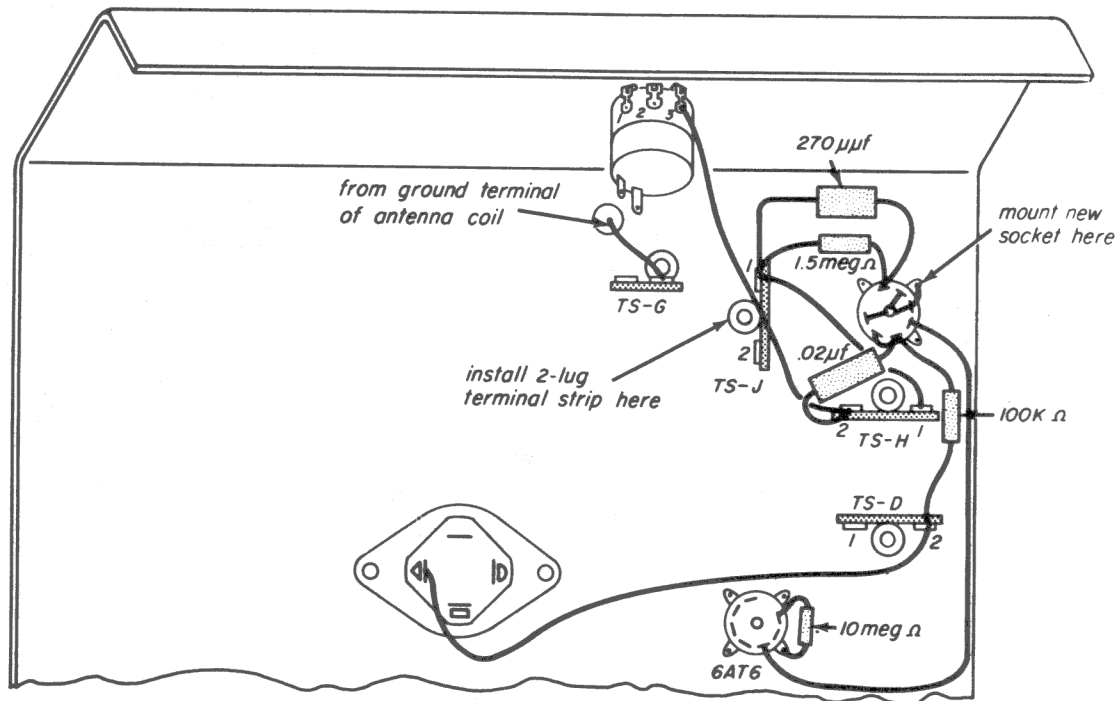


Fig. 27-8

JOB 27-2

To construct a triode grid-leak detector.

Procedure.

Step 1. Remove the crystal diode and replace it in the meter.

Step 2. Remove the diode holder from across TS-H, and put it aside.

Step 3. Remove the 0.1- μ f capacitor across TS-F, and remove the wires from TS-F to the 6K6-GT socket and the 6AT6 socket.

Step 4: Remove the 10-megohm resistor and all wiring from TS-D.

Step 5. Connect the 10-megohm resistor from pin 1 of the 6AT6 socket to the ground lug near pin 3 of that socket, as shown in Fig. 27-8.

Step 6. Mount a 7-pin miniature socket in the position shown in the figure. Make sure that the blank space between pins 1 and 7 is closest to the volume control, as shown. This socket is for the 6BA6 tube, and will be the rf stage in the completed receiver.

Step 7. Permanently connect together and solder pins 2 and 3 and the center post, all on the 6BA6 socket, to the ground lug near pin 3 of this socket as shown in Fig. 27-8.

Step 8. Temporarily connect pin 7 to the center post.

Step 9. Connect a wire for filament voltage between pin 3 of the 6AT6 socket and pin 4 of the 6BA6 socket, as shown.

Step 10. Install a 2-lug terminal strip using one of the capacitor mounting screws, as shown in the figure. This terminal strip will be referred to as TS-J. Label it on your chassis.

Step 11. Connect a 270- μ f capacitor and a 1.5-megohm resistor from pin 1 of the 6BA6 socket to lug 1 of TS-J, as shown in the figure.

Step 12. Connect together lug 1 of TS-J and lug 1 of TS-H with a short lead.

Step 13. Connect a 100 k-ohm resistor from pin 5 of the 6BA6 socket to lug 2 of TS-D. Use spaghetti wherever necessary.

Step 14. Connect a wire between the Δ (triangle) section of the electrolytic

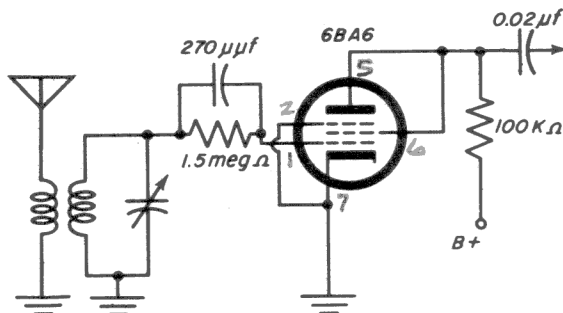


Fig. 27-9

capacitor and lug 2 of TS-D.

Step 15. Connect a 0.02- μ f capacitor from pin 5 of the 6BA6 socket to lug 2 of TS-H.

Step 16. With a very short piece of bare wire, temporarily connect pins 5 and 6 of the 6BA6 socket together.

Step 17. Slip the pickup coil on the antenna coil and connect one of its leads to the GND terminal of the antenna coil. Connect the other lead to lug 2 of TS-I. Connect your 10-foot or longer antenna wire to lug 2 of TS-I on top of the chassis.

Step 18. The circuit you have wired is shown in Fig. 27-9. Check your chassis against this schematic and make sure it is correct before you proceed.

JOB 27-3

To become familiar with the 6BA6 characteristics as given in the manual.

Procedure.

Step 1. Look up the 6BA6 tube in the tube manual, and fill out the following:

Type of tube: REMOTE W/TOFF PENTODE

Heater: voltage 6.3 volts current 300 ma

Maximum plate voltage: 330 volts

Maximum plate dissipation: 3.4 watts

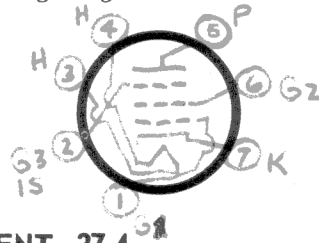
Maximum screen dissipation: NO DATA watts

Mutual conductance: 4400 μ mhos

Plate resistance: 1,000,000 ohms

*Based on a plate voltage of 250 volts

Draw a basing diagram of the tube:



EXPERIMENT 27-4.

To study the characteristics of the triode grid-leak detector.

Procedure.

Step 1. Insert a 6BA6 tube in the socket, plug in the receiver, and allow the tubes to warm up.

Step 2. Measure the d-c voltages at the points called for in Table A, and compare them with the normal operating voltages given in the table. If there is a discrepancy of much more than 20%, find the trouble by checking against the schematic diagram of Fig. 27-9 before you proceed. Consult your basing diagram for the proper pin numbers.

TABLE A

TRIODE GRID-LEAK DETECTOR

	Measured Voltage	Normal Voltage
Plate	<u>30</u>	30
Grid	<u>-0.6</u>	± 0.7

Step 3. Adjust the core of the antenna coil so that the top of the core is about 1/4- to 3/8-inch inside the coil form. Tune the variable capacitor through its range, and listen for broadcast stations. How does the performance of this detector compare with the diode detector?

Sensitivity:

Does it pick up more stations?

NO

Selectivity:

Is it easier to separate or select the

*Considerable variation may be expected in this reading.

desired station?

NO

How does it compare with the diode detector?

not so good

Output volume:

How does it compare with the diode detector?

not as much

Step 4. Unplug the receiver. Disconnect the lead from lug 2 of TS-H and temporarily connect it to pin 1 of the 6BA6. Plug in the receiver and repeat Step 3.

Is an audio signal heard in the loudspeaker?

yes

Does this mean that there is a demodulated or detected signal at the grid of the tube?

yes

Does detection take place in the grid circuit or the plate circuit?

grid

How does the audio signal compare with that of the diode detector?

weaker

Step 5. Unplug the receiver and replace the lead from pin 3 of the volume control to lug 2 of TS-H.

EXPERIMENT 27-5:

To construct and study the characteristics of a pentode grid-leak detector.

Procedure.

Step 1. Connect your 10 k-ohm 5-watt resistor from the Δ (triangle) section of the electrolytic capacitor to lug 2 on TS-F, as shown in Fig. 27-10.

Step 2. Connect the 5 k-ohm 10-watt re-

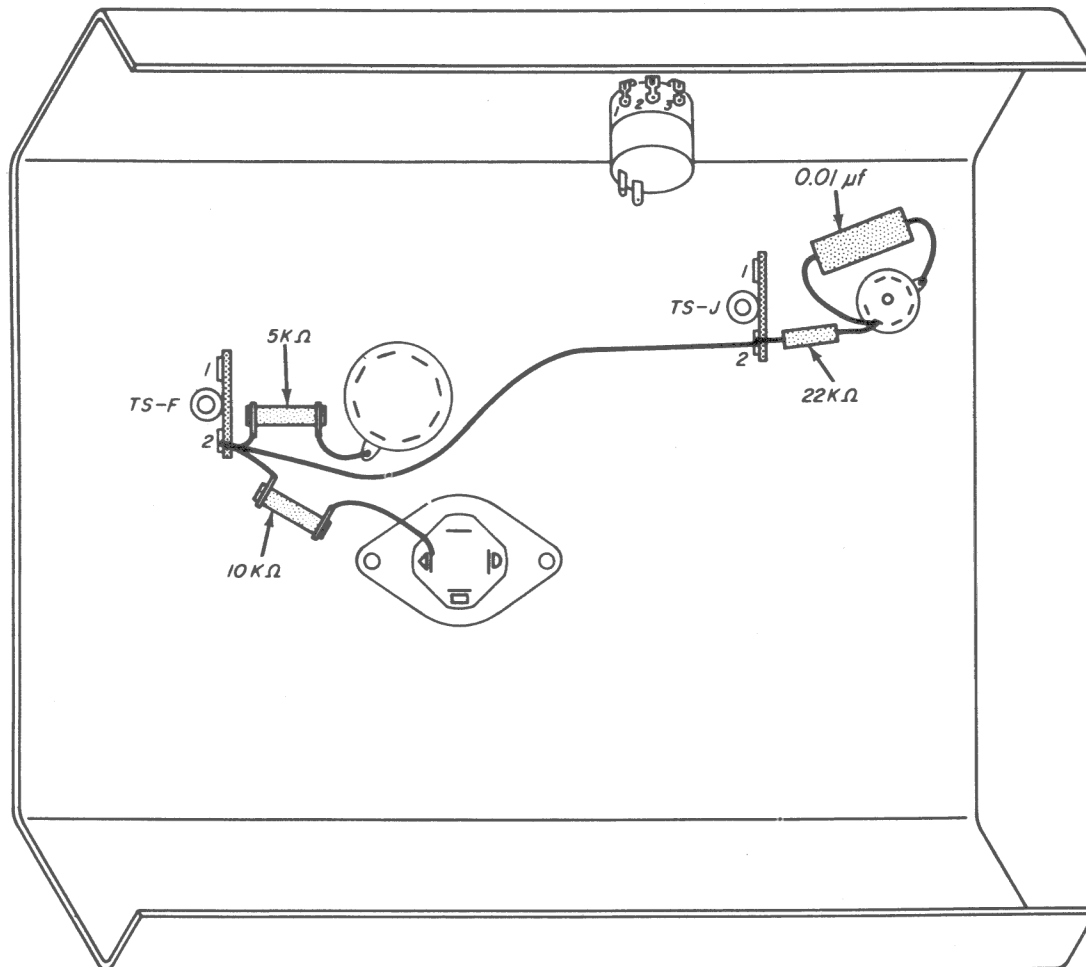


Fig. 27-10

sistor from lug 2 on TS-F to the ground lug near pin 4 on the 6K6-GT socket.

Step 3. Connect a lead from lug 2 on TS-F to lug 2 on TS-J.

Step 4. Remove the short across pin 5 and 6 of the 6BA6 tube socket.

Step 5. Connect a 22 k-ohm resistor from lug 2 on TS-J to pin 6 of the 6BA6 tube socket.

Step 6. Connect a 0.01- μ f capacitor from pin 6 of the 6BA6 socket to a ground lug on the socket.

Step 7. Plug in the receiver, and allow the tubes to warm up.

Step 8. Measure the voltages at the various tube electrodes as called for in Table B, and compare them with the normal operating voltages given in the table. If there is a discrepancy of much more than 20 percent, find the trouble by checking against Fig. 27-10 and the schematic diagram of Fig. 27-11 before you proceed with the experiment.

TABLE B

PENTODE GRID-LEAK DETECTOR

	Measured Voltage	Normal Voltage
*Plate	8	7
Screen	40	40
**Grid	-0.7	-0.6

Step 9. Tune the variable capacitor through its range, and listen for broadcast stations. Check to see that your antenna is connected to lug 2 of TS-I on top of the chassis and the pickup coil is slipped over the antenna coil. How does the performance of this detector compare with the performance of the other detectors?

Sensitivity:

Does it pick up more stations?

yes

*With no signal input.

**Considerable variation may be obtained here.

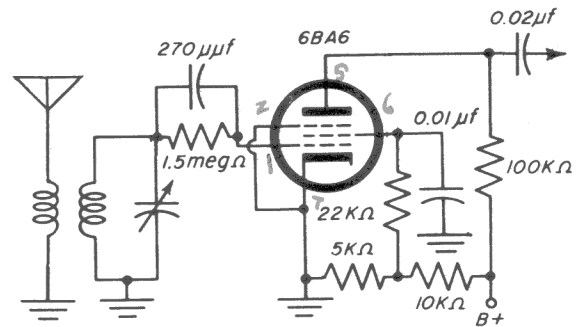


Fig. 27-11

Selectivity:

Is it easier to select the desired station?

No

Output Volume:

How does the output volume of this detector compare with that of the other detector?

more

Step 10. Disconnect the receiver.

Step 11. Remove the 1.5-megohm grid resistor from across the capacitor and connect it from the grid to a grounding lug on the 6BA6 tube socket. The circuit should now be as in Fig. 27-12.

Step 12. Plug in the receiver and allow the tubes to warm up.

Step 13. Repeat Step 9. Does the change in grid-leak resistor wiring affect the operation of the detector?

Discussion. As your results should show, the grid leak detector is an extremely sensitive detector, and the pentode grid-leak detector is capable of producing even greater output volume. However, the selectivity is not much better than that of the diode detec-

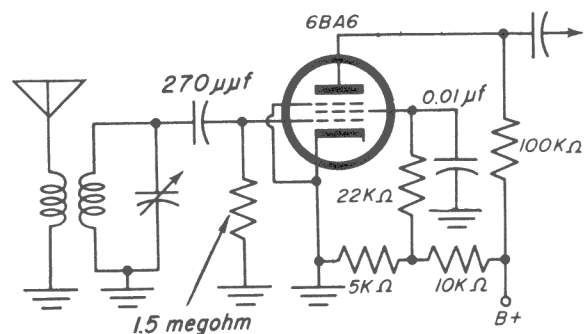


Fig. 27-12

tor. In locations where there are many strong stations, stations will be hard to separate, and one or more will be heard in the background. Detection in the grid-leak detector actually takes place in the grid circuit, as shown in Step 4 of Experiment 27-4, where you should have been able to get an audio signal at the grid of the detector tube. This demonstrates that the action of the grid-leak detector is very similar to that of a diode detector, with the grid and cathode of the tube acting much like the plate and cathode of a diode. The amplified audio output appears at the plate of the detector tube. When the grid resistor is taken from across the capacitor, as in Fig. 27-11, and connected from grid to ground, as in Fig. 27-12, no difference in operation is noted, since there is no significant difference between the two circuits. The schematic in Fig. 27-12 is just another way of drawing the circuit. The grid leak detector forms the

basis of the regenerative detector, which you will construct in a later lesson.

EXPERIMENT 27-6

To construct and study the characteristics of a pentode plate detector.

Procedure.

Step 1. Disconnect and put aside the $270\text{-}\mu\text{mf}$ capacitor and the 1.5 megohm resistor.

Step 2. Disconnect the lead at lug 1 of TS-J, and connect it to pin 1 of the 6BA6 tube, as in Fig. 27-13.

Step 3. Disconnect the wire shorting pin 7 of the 6BA6 socket to the centerpost, and insert a 1,000-ohm resistor between pin 7 and chassis.

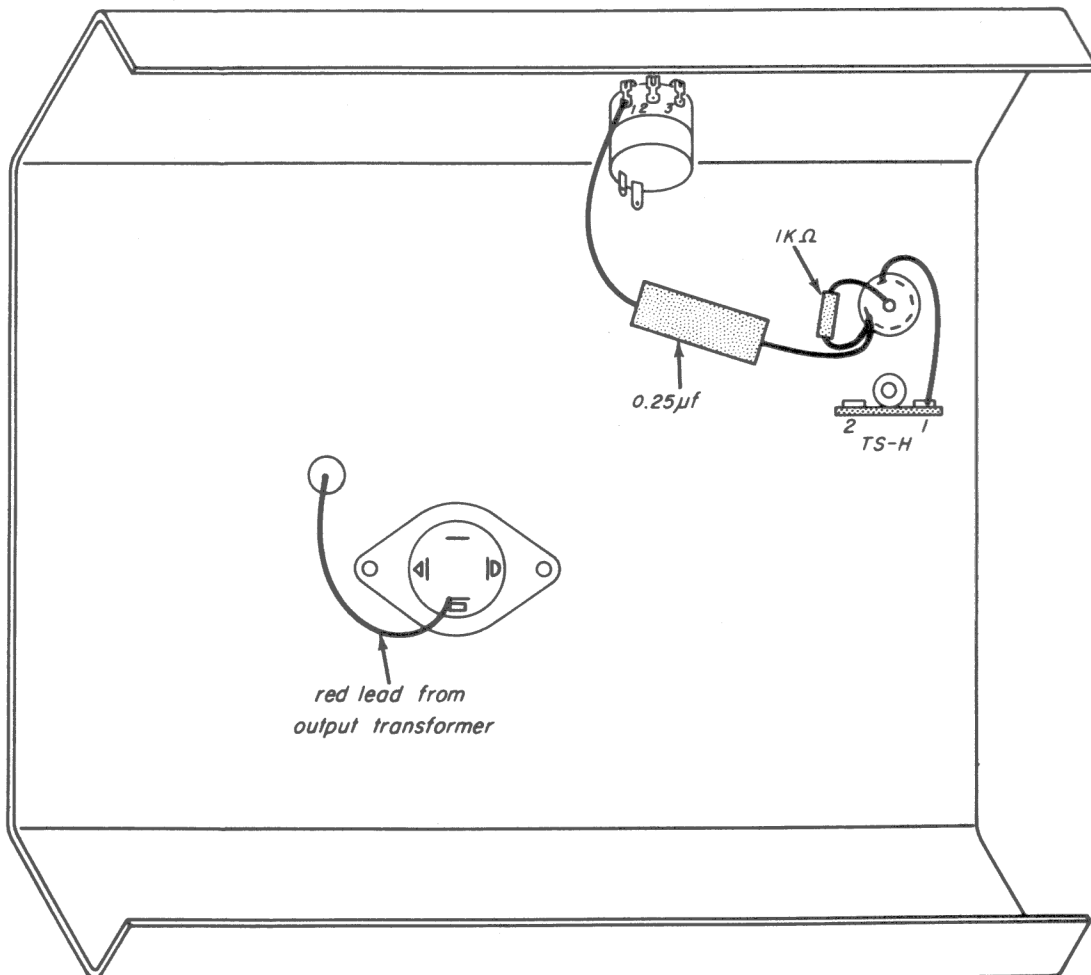


Fig. 27-13

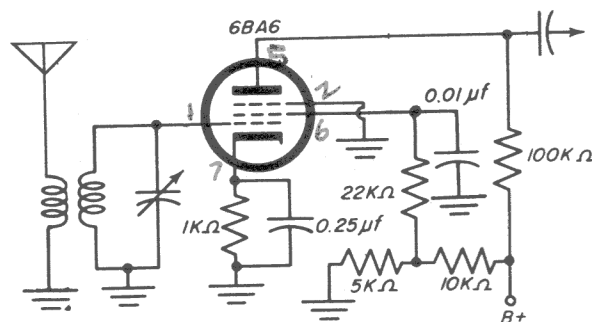


Fig. 27-14

Step 4. Remove the 0.25- μ f capacitor from the capacitor board, and connect it to pin 7 of the 6BA6 tube and the ground terminal on the volume control, as in the figure.

Step 5. Disconnect the red lead of the output transformer that is connected to the Δ section of the electrolytic capacitor and connect it to the $\square$ section of the capacitor.

Step 6. Plug in the receiver, and allow the tubes to warm up.

Step 7. Measure the voltages at the various tube electrodes as called for in Table C, and compare them with the normal operating voltages given in the table. If there is a discrepancy of much more than 20 percent, find the trouble by checking against the schematic diagram of Fig. 27-14 before you proceed with the experiment.

Step 8. Disconnect the receiver. Unsolder the 100 k-ohm resistor at the plate (pin 5). Insert the meter and measure the plate current. Record it here. 1.9 ma

Step 9. Disconnect the meter and resolder the resistor. Judging from the plate current measurement, is the tube near cutoff? yes

Step 10. Check to see that the external antenna is connected to TS-I, and slip the pickup coil over the antenna coil. Then tune through the broadcast band and note the performance of this detector:

Sensitivity: No

Selectivity: Yes

How sharp is the tuning? Sharp

Can stations be separated? Yes

Output Volume: Medium

Step 11. Unplug the receiver.

Step 12. Disconnect the lead from the volume control at lug 2 of TS-H and temporarily connect it to the grid (pin 1) of the 6BA6 tube.

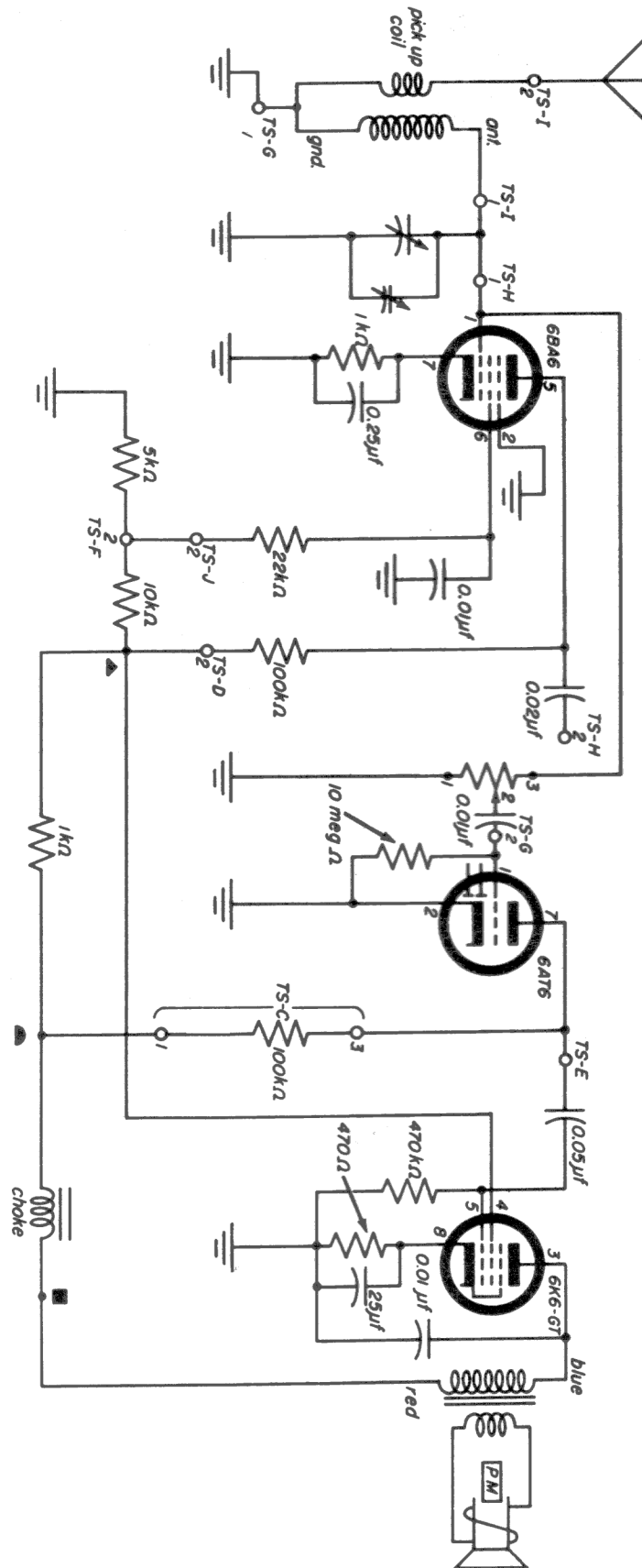
Step 13. Plug in the receiver and allow the tubes to warm up. Is an audio signal heard in the loudspeaker? Where does detection take place in this circuit?

TABLE C

PENTODE PLATE DETECTOR

	Measured Voltage	Normal Voltage
Plate	<u>56</u>	60
Screen	<u>55</u>	55
Grid	<u>0</u>	0
Cathode	<u>2.5</u>	2.5

Discussion. The sensitivity of the plate detector is intermediate between that of the diode detector and the grid-leak detector. It has the advantage of less circuit loading, resulting in much sharper tuning. No audio signal is present at the grid of this detector, showing that detection takes place due to plate rectification of the incoming signal. As shown by the cathode-bias voltage and the plate-current measurement, rectification is produced by biasing the tube close to cutoff, so that only the positive halves of the input signal are amplified. The plate current is about 1.5 ma.



Condition of Radio Receiver Chassis at End of Experiment Lesson 27